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REVIEW ARTICLE

ICU performance metrics and ICU outcomes.

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ABSTRACT

Quality indicators (QIs) are integral to the operation of modern Intensive Care Units (ICUs). Over the years, impetus on quality patient care has greatly increased. The quality standards used in the industrial, educational sectors were tweaked to fit the needs of the health care sector. Effective quality indicators ensure treatment is safe, effective, efficient, timely, and patient-centred. Meanwhile, they should also help in identifying the deficiencies in the present health care system and rectify them. The QIs have garnered interest in the recent years as various national and international accreditation bodies have endorsed them to certify the hospitals. The World Patient Safety Day is being celebrated every year on September 17 since 2019. This clearly shows that integrating patient safety with health care is pivotal in ensuring universal health coverage. In this mini review, we will be providing a brief overview of the various quality indicators (QIs) that are routinely used, role of the accreditation bodies in ensuring quality care to the patients and the future of quality indicators.

Keywords: *intensive care, patient safety, quality indicators, quality outcomes, universal health coverage.*

INTRODUCTION

Patient safety and quality care has been given paramount importance since the ancient times. The history of quality control in health care dates back to the Hippocratic oath. The cardinal feature of Hippocratic oath "Avoid causing harm" encompasses the spirit of quality care to the patients.[1,2] As per the Global Patient safety report 2024, published by the World health Organisation (WHO), 3 million deaths occur annually due to unsafe care.[3] The dire statistics clearly foreshadow the need for adequate quality control measures to improve patient care.

The Institute of Medicine (IOM) published a landmark report in 1999 titled "To Err is human" which highlighted the issues of medical errors and patient safety in health care. The above report described quality care in health care as care that is safe, timely, effective, efficient, equitable and patient centered.[4] This seminal paper spearheaded a global conversation on patient centred quality health care. The quality control measures taken in other sectors served as a guide for the present-day quality indicators (QI) in the health sector. The foundations for the same were laid in the latter years of 20th century and the first decade of 21st century.[5,6]

Dr Bjorn Isben, the "father" of intensive care set up the first intensive care unit in 1953.[7] The intensive care units (ICUs) are the backbone of modern health care system. The last 25 years have witnessed a paradigm shift in terms of quality care to the patients admitted in the ICU and other highly specialized centers of hospital like emergency, surgical units.[3,8] The heterogeneity of patients, multiple life sustaining technologies like invasive ventilation, renal replacement therapy and high cost make it all the more pertinent that quality indicators are in place for the smooth and efficient functioning of the ICU.[2,9]

The Global patient Safety action plan 2021- 2031, adopted by the WHO in 2021 is a testament to its resolve of achieving universal safe and quality health care.[3] The quality indicators, and ICU performance metrics will guide the policy makers in realising the vulnerabilities of the health care system and plan corrective actions.

In this mini- review, we will answer a few key questions regarding ICU performance metrics and outcome measures which would reflect the quality of care provided in ICU.

Why do we need quality indicators in ICU?

Indian Society of Critical care Medicine (ISCCM), established in 1993 is the largest non- profit professional body of critical care physicians in India. It is responsible for formulating standards and guidelines for ICU practices in India. ISCCM led the way in developing the key performance indicators (KPIs) for the ICUs.[10] The report published in 2009, served as a guide for the Indian accreditation bodies to devise the quality standards.

Likewise, the ISCCM in its 2020 guidelines specified that the total number of ICU beds in any hospital should not be less than 5% of the total bed strength of the hospital.[11] Hence, with ever increasing intensive care units, the institutions and the national accreditation bodies have mandated the monitoring of QIs in ICU.[12]

The quality indicators, as mentioned in the report by IOM serve the following purposes:[2,4]

a. Ensure patient safety
b. Use of evidence- based practices that are shown to be efficient and cost effective.
c. Provide patient centered care
d. Ensure timely and equitable delivery of care

Importantly, quality indicators enable the healthcare sector to identify and address deficiencies.[12]

What are the characteristics of a good quality indicator for the ICU?

A good quality indicator should ideally have following characteristics.[13,14]

a. Important: The quality indicator must focus on essential structural, procedural and outcome measures in ICU. Eg: QIs measuring VAP rates, staffing pattern, etc.
b. Relevant: A quality indicator needs to be relevant to the patient, thus maintaining the patient care as the top most priority.
c. Feasible: The f'easibility of a quality indicator is enhanced by the ease of data collection.
d. Valid: The pilot indicator has to be thoroughly studied, evaluated and validated before being adopted in the ICU. Validity of a quality indicator increases if it can used across all the populations.
e. Interpretable: The quality indicator must be easy to measure and interpret.

How to decide on quality improvement initiatives in ICU?

Donabedian pioneered the 'Structure-Process-Outcome' model, which facilitates the evaluation of patient care quality (Figure 1).[6]

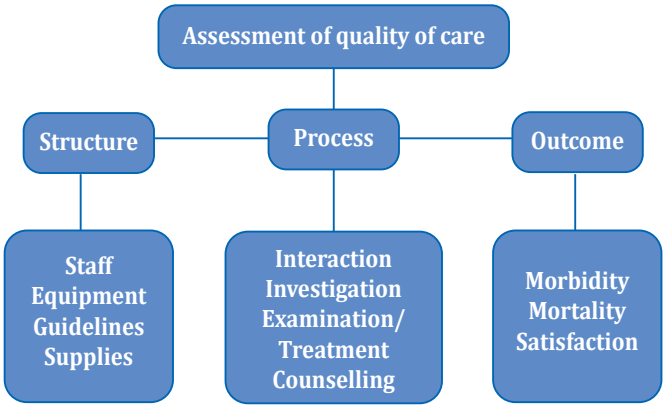

Figure 1. *Quality improvement- Donabedian model.*[6]

The above model helps in comprehensive assessment of healthcare quality. In the above model, "structure' refers to physical and organizational aspects of health care delivery such as staff patient ratio; "process" embodies the actions and procedures involved in delivering health care services such as diagnostic practices and lastly "outcome" focuses on the results of care provided such as patient satisfaction.[6] To summarize, improvements in structure will lead to better process and hence achieve better outcome. While implementing a quality improvement initiative in ICU, it is always better to target the process of care as we can always measure the outcomes.[2]

Other models which have been used include Comprehensive Unit Based Safety Program (CUSP) model[15] and General Outcome Prediction Model (GOPM).[16,17]

The CUSP model integrates teamwork, communication and safety practices to reduce patient harm in health care facilities. This model has been effectively used to reduce procedural complications.[18]

On the other hand, GOPM focusses on mortality as outcome measure. Standardized Mortality Ratio (SMR) has been widely used across the ICUs as the measure for mortality.

However, a single measure can't be homogenously used to reflect the quality of care and ICU performance. Hence, APACHE,[19] Simplified Acute Physiology score (SAPS)[20] and Mortality prediction model (MPM)[21] were developed which are better suited in predicting overall mortality in ICU. Likewise, the bundle care approach, all or none strategy[22] have been tried and tested to assess the process of care in ICU. Setting up seemingly impossible stretch goals and zero- event targets should be avoided while devising quality improvement initiatives.[12,23]

What are the most commonly used QIs in ICU?

Jawad et al published a scoping review in 2021. A total of 123 articles were included in the scoping review and total of 51 quality indicators were shortlisted.[24] It is difficult to pin point the exact number of quality indicators which can be used at any given point of time in an ICU.[25] The numbers may vary depending upon the type of ICU, patient heterogeneity and even the population it caters to. Moreover, the quality indicators are updated and reinvented depending upon the current evidence.[12] Hence, the repertoire of quality indicators is highly dynamic.

For the ease of understanding, quality indicators can be divided into following domains (Table 1):[12]

1. Safety
2. Effectiveness
3. Timeliness
4. Efficiency
5. Patient/ family centered outcome
6. Staff work life

Table 1. List of common ICU quality indicators and their respective domains:[12]

S. No.	Quality indicator domain	Examples
1	Safety	24-hour coverage by intensivist; hand hygiene; Incidence of ventilator associated pneumonia (VAP), Central Line associated Blood stream infection (CLABSI); Patient- nurse ratio; unplanned extubation; structured handover at transition of care
2	Effectiveness	ICU length of stay; ICU mortality; extubation failure rate
3	Timeliness	ICU occupancy, ICU discharges that occur at night
4	Efficiency	Ventilated patient flow; avoidable days in ICU
5	Patient / Family centered outcome	Pain assessment; patient/ family satisfaction
6	Staff work life	Absenteeism; staff turnover

What are the initiatives taken by the accreditation bodies to improve ICU outcomes?

As an example, India has developed robust accreditation bodies for the quality control across all the health care facilities in recent years. National Accreditation Board for Hospitals and healthcare providers (NABH), a constituent board of Quality Control India (QCI), was set up in 2005. NABH certification is awarded to the health care organizations that adhere to stringent quality and patient safety standards. NABH accreditation is considered as a mark of quality and reliability, thus building up the trust between the patients and the health care organization. As a part of its certification, NABH has laid out a set of QIs focusing on monitoring and improving the patient care in ICUs. For instance, infection rates, mortality rates, length of stay. Periodic audits ensure that the gaps in patient care are identified and addressed effectively.

This was followed by setting up of National Quality Assurance Standards (NQAS) for public health facilities in 2013.[26] Various other government initiatives like Kayakalpa in 2015 and National Action plan for Anti- microbial resistance (NAP-AMR) in 2017 have prioritized on improving the patient care across all the health care facilities.[27] Kayakalpa promoted cleanliness, hygiene and infection control practices in the public health sector. On the other hand, NAP- AMR initiative focused on combating anti- microbial resistance through surveillance and optimizing antibiotic use in ICUs.

National Patient Safety Implementation Framework (NPSIF, 2018- 2025) intends to integrate the key patient safety initiatives in India.[26] This is fully aligned with the "Regional Strategy for Patient safety in the WHO South east Asia region", thus making India a global partner in building up a strong foundation for improved patient safety standards.

What are the future directions while assessing ICU performance?

The COVID- 19 pandemic, opened up novel health care avenues like Tele- ICU. Setting up tele ICUs helped in mitigating the infrastructural fallout during the pandemic. Advancements in remote monitoring tools, real time transmission of patient data, timely interventions have improved the patient care. There is evidence of telemedicine helping in reducing mortality and length of stay.[28] Integrating Artificial intelligence (AI) into tele ICU model can help in developing predictive algorithms which can identify early signs of patient deterioration. Diligent use of AI can make ICU practices that are personalized, predictive and precise.[29] Ethical and legal considerations, data biases, irrelevant and data overload, cost considerations, privacy breach, are few of the challenges faced in integrating AI with healthcare sector.

To conclude, ICU metrics & ICU outcomes are key parameters not only to monitor & ensure high standards of evidence based safe care to the patients but also to objectively compare the care between different ICUs thereby gaining an opportunity to rectify the deficiencies. The quality parameters can broadly be analysed under the headings of safety, effectiveness, timeliness, efficiency, patient/family centred outcomes and staff work life. The gradual shift towards aligning the quality indicators which are patient centred is a remarkable feat on its own. The global patient safety action plan was adopted by Seventy-Fourth World Health Assembly in 2021 with a vision of "a world in which no one is harmed in health care, and every patient receives safe and respectful care, every time, everywhere".[3] Implementation & surveillance of ICU metrics and ICU outcomes across the globe will definitely help to ensure delivery of evidence based and safe delivery of critical care services. This in turn would guarantee attaining universal health coverage where patient centred safe practices are upheld.[30]

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